Investigative studies on the effects of tyre inflation pressure on the motion resistance of pneumatic bicycle wheels on hard and deformable surfaces

ABSTRACT

The effects of tyre inflation pressures on the motion resistance of four pneumatic bicycle wheels on four test surfaces were investigated using the previously developed motion resistance test rig for traction studies. The motion resistances which is equal to the towing force were measured with the aid of the Mecmesin Basic Force Gauge (BFG 2500) mounted on the test rig and RS 232 interfaced to the notebook PC for real time data acquisition. Four pneumatic bicycle wheels of overall wheel diameter of 660 mm, 610 mm, 510 mm and 405 mm. The four test surfaces were the paved, grass field, tilled and wet surfaces. Three inflation pressures of 276 kPa (40 psi), 345 kPa (50 psi) and 414 kPa (60 psi) were chosen and investigated in the study. This study was conducted at four levels of added dynamic loads at a constant tractor towing velocity of 4.44 km/h. There were significant differences between motion resistances measured on different test surfaces and at different dynamic loads and different tyre inflation pressures. The motion resistances measured against each wheel show that at lower inflation pressure (276 kPa), the motion resistances were higher and decreased as the tyre inflation pressure increased especially with 660 mm and 610 mm wheels. With higher dynamic load and higher inflation pressure, the motion resistance was considerably lower compared with low pressure and higher loads. This information would be useful in the development of the low cost and easy to maintain agricultural machinery for low income farmers and rural dwellers.

Keyword: Motion resistance; Motion resistance ratio; Overall wheel diameter; Test surfaces; Dynamic loads; Test rig